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# **Service Station Facility**

## **Facility Environmental Monitoring Report**

**Calendar Year 2002**



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# **Brookhaven National Laboratory Service Station Facility**

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#### ***Summary of Results***

*As in past years, high levels of carbon tetrachloride (up to 1,940 µg/L) continue to be detected in a number of wells used to monitor the Service Station facility. The carbon tetrachloride was released from a former underground storage tank that was used for a Chemistry Department experiment in the 1950s. This tank was located approximately 200 feet northwest (upgradient) of the station. The carbon tetrachloride plume is being remediated as part of the Environmental Restoration Program.*

*Low levels of volatile organic compounds associated with petroleum products (e.g., ethylbenzene, xylene, trimethylbenzenes) continue to be detected in several monitoring wells located directly downgradient of the station. The solvent tetrachloroethylene was detected in several wells at a maximum concentration of 24.7 µg/L. Additionally, the gasoline additive MTBE was detected in two wells at a maximum concentration of 32.8 µg/L. Available information indicates that the station's underground storage tanks and associated distribution lines are not leaking and that all waste oils and used solvents are being properly stored and recycled. Therefore, it is believed that the petroleum hydrocarbon-related compounds and solvents detected in groundwater originate from historical vehicle maintenance operations prior to improved chemical storage and handling controls implemented in 1989.*

*A problem with the lift station in southern service bay (#3) was reported in October 2001, and the lift was immediately drained and removed from service. The hydraulic oil reservoir tank and the cylinders were removed on April 1, 2002. Following the removal, several areas of soil contamination were noted; approximately seven cubic yards of soil were removed. Low levels of tetrachloroethylene were found. Endpoint samples verified that the cleanup successfully removed soils with concentrations above Suffolk County Department of Health Services Action Levels.*

## **Background**

Building 630 is a commercial automobile service station, privately operated under a contract with BNL. The station, which was built in 1966, is used for automobile repair and gasoline sales.

Potential environmental concerns at the service station include the historical use of underground storage tanks (USTs) to store gasoline and waste oil; hydraulic fluids used for lift stations; and the use of solvents for parts cleaning. When the service station was built in 1966, the UST inventory consisted of one 6,000-gallon tank and two 8,000-gallon tanks for storing gasoline, and one 500-gallon tank for used motor oil. An inventory discrepancy discovered in 1967 suggested that up to 8,000 gallons of gasoline might have leaked from one of the USTs. There are no records of remedial actions other than the

replacement of the tank, and the loss of 8,000 gallons of gasoline has never been confirmed. In August 1989, the gasoline and waste oil USTs, pump islands, and associated piping were upgraded to conform to Suffolk County Article 12 requirements for secondary containment, leak detection devices, and overfill alarms. During the removal of the old USTs, no obvious signs of soil contamination were observed.

The present tank inventory includes three 8,000-gallon USTs used to store unleaded gasoline, one 500-gallon UST for waste oil, and one 1,000-gallon UST for fuel oil. The facility also has three vehicle lift stations.

## Environmental Monitoring Program

In 1996, BNL established a groundwater monitoring program at the service station to evaluate potential impacts to environmental quality. The environmental monitoring program for the service station is described in the *BNL Environmental Monitoring Plan* (BNL, 2000; BNL, 2002).

## Monitoring Results

### Groundwater

The service station's groundwater monitoring program is designed to confirm that the engineered and institutional controls in place are effective in preventing contamination of the aquifer. Five wells are used to monitor for potential contaminant releases (Figure 1). Two of these wells (085-236 and 085-237) were installed in January 2000 immediately downgradient of the gasoline UST area.

Groundwater quality in the service station area has been impacted by historical small-scale spills of oils, gasoline, and solvents such as carbon tetrachloride and PCE (tetrachloroethylene). Although carbon tetrachloride may have been used at the service station, it is believed that the high levels of this compound detected in several of the monitoring wells relate to releases from a nearby UST that was used as part of an experiment conducted in the 1950s. In April 1998, BNL removed a deeply buried UST from an area approximately 200 feet northwest (upgradient) of the service station. Although there are indications that the tank was releasing small quantities of carbon tetrachloride prior to the tank removal, the detection of a significant increase in carbon tetrachloride concentrations in groundwater suggests that additional amounts of this chemical were inadvertently released during the excavation and removal process. BNL started to remediate the carbon tetrachloride plume in October 1999.

During 2002, carbon tetrachloride continued to be observed in the service station monitoring wells (Tables 1 through 6). The maximum carbon tetrachloride concentration was 1,940 µg/L, observed in well 085-16 during January 2002. Carbon tetrachloride concentrations decreased during the year, with concentrations dropping to less than 262 µg/L by December (see *BNL Groundwater Status Report for 2002* for details on the

carbon tetrachloride plume and remediation system). These concentrations are considerably less than those observed in CY 2000, when carbon tetrachloride concentrations in wells near the service station approached 4,400 µg/L. The New York State Ambient Water Quality Standard (NYSAWQS) for carbon tetrachloride is 5 µg/L.

In addition to the carbon tetrachloride contamination from the former UST area described above, groundwater quality has been affected by a variety of petroleum- and solvent-related VOCs that appear to be related to historical service station operations. During the first half of 2000, high levels (>100 µg/L) of petroleum-related compounds such as xylene and ethylbenzene were detected in wells 085-17, 085-236, and 085-237 (see Figures 3, 4 and 5). From mid-2000 through mid-2002, individual VOC concentrations generally decreased to less than 10 µg/L. However, in September and December 2002 there was a slight increase in PCE (up to 24.7 µg/L) and total xylene concentrations (up to 46.1 µg/L) in samples collected from well 085-236 (Figure 4).

The gasoline additive methyl tertiary butyl ether (MTBE) continues to be detected wells 085-236 and 085-237. However, MTBE levels decreased from a maximum concentration of 64 µg/L in 2001, to a maximum concentration of 32 µg/L in 2002. MTBE has been in use as a gasoline additive since 1977, and it is possible that the MTBE detected in the service station wells is related to historical vehicle maintenance operations or small-scale spillage of gasoline during vehicle refueling. The NYSAWQS for MTBE is 10 µg/L.

No SVOCs or floating petroleum was detected in the monitoring wells during 2002 (Table 7).

Monitoring wells 085-17, 085-236, and 085-237 are downgradient of the southern end of the service station building, and it is possible that the PCE and petroleum-related chemicals detected in groundwater are due to historical discharges to the abandoned service bay floor drains (see discussion below).

## **Evaluation of Service Station Operations**

During 2002, there were no reported gasoline or motor oil losses or spills that could affect groundwater quality, and all waste oils and used solvents generated from current operations are being properly stored and recycled. The gasoline USTs have electronic leak detection systems, and there is a daily product reconciliation (i.e., an accounting of the volume of gasoline stored in underground storage tanks and volume of gasoline sold). During 2002 there were no indications of leaks in the underground storage tanks or associated piping.

A problem with the lift station in the southern service bay (#3) was reported in October 2001, and the lift was immediately drained and removed from service (Cunniff, 2002). The hydraulic reservoir tank and the cylinders were removed on April 1, 2002. Following the removal, several areas of soil contamination were noted. Approximately seven cubic yards of soil were removed, and endpoint samples were collected and analyzed for VOCs

and SVOCs. The analytical results indicated that the remaining soils had concentrations well below Suffolk County Department of Health Services Action Levels. Of particular note was the detection of the solvent PCE at concentrations up to 47 ug/kg, and trace levels of chloroform and carbon tetrachloride (<8 ug/kg). These solvents are likely to have originated from historical discharges to a former floor drain that was in this area. It is possible that these discharges are the source of some of the PCE and petroleum-related chemicals detected in monitoring wells.

## Future Monitoring Actions

The following actions are recommended for the CY 2003 monitoring period:

- The Environmental Restoration Program will sample four of the five service station wells quarterly for VOCs, as part of the carbon tetrachloride plume monitoring project. The Environmental Surveillance Program will sample one well (085-235) semiannually for VOCs, and all five wells semiannually for floating product.
- Because monitoring continues to indicate nondetectable levels of SVOCs, sampling frequency for SVOCs will be reduced to once every two years.

## References

BNL, 2000. *Brookhaven National Laboratory, Environmental Monitoring Plan 2000* (March 31, 2000).

BNL, 2002. *Brookhaven National Laboratory Environmental Monitoring Plan, CY 2002 Update* (January 2002). BNL-52584 Update.

Cunniff, L., 2002. Letter from L. Cunniff to R. Desmarais, *Tank Removal Summary Reports and Close-Out of NYSDEC Spill Numbers* (August 30, 2002).

Table 1. January 2002 VOC Analytical Results for Service Station Facility.

Compound	NYSAWQS (µg/L)	Well 085-235	Well 085-016)	Well 085-017	Well 085-236	Well 085-237
		----- (µg/L) -----				
Carbon tetrachloride	5	NS	1,940 D	409 D	293 D	178 D
Methylene chloride**	5		15.2	<0.5	<0.5	<0.5
Chloroform**	7		32.9	25.2	10.7	9.0
Toluene	5		<10.0	<0.6	<0.5	0.31J
Tetrachloroethylene (PCE)	5		5.5J	11.1	3.6	2.4
Ethylbenzene	5		<10.0	<0.5	<0.5	<0.5
m,p-Xylenes	5		<10.0	<0.5	<0.5	<0.5
o-Xylene	5		<10.0	<0.5	<0.5	<0.5
Isopropylbenzene	5		<10.0	<0.5	<0.5	<0.5
n-propylbenzene	5		<10.0	<0.5	<0.5	<0.5
1,3,5-Trimethylbenzene	5		<10.0	<0.5	<0.5	<0.5
1,2,4-Trimethylbenzene	5		<10.0	<0.5	<0.5	<0.5
1,1,1-trichloroethane	5		<10.0	<0.5	<0.5	<0.5
Naphthalene	10		<10.0	<0.5	<0.5	<0.5
Methyl tertiary butyl ether (MTBE)	10		<10.0	1.3	NA	NA
Total VOC Concentration	--		1,993.6	447.2	312.2	189.7

<sup>a</sup> Standard not established – default value shown.

B = Compound also detected in blank sample.

J = Estimated analytical value.

D = Analytical value following dilution.

NA = Compound not analyzed for.

\*\* Primary breakdown products of carbon tetrachloride

Table 2. March 2002 VOC Analytical Results for Service Station Facility.

Compound	NYS AWQS (µg/L)	Well 085-235	Well 085-016)	Well 085-017	Well 085-236	Well 085-237
		----- (µg/L) -----				
Carbon tetrachloride	5	106 D	1,342 D	374 D	328 D	183 D
Methylene chloride**	5	<2.0	<2.0	<2.0	<2.0	<2.0
Chloroform**	7	12.3	31.0	31.0	20.6	14.0
Toluene	5	<2.0	<2.0	<2.0	<2.0	<2.0
Tetrachloroethylene (PCE)	5	0.6J	3.7	8.9	3.2	2.3
Ethylbenzene	5	<2.0	<2.0	<2.0	<2.0	<2.0
m,p-Xylenes	5	<2.0	<2.0	<2.0	<2.0	<2.0
o-Xylene	5	<2.0	<2.0	<2.0	<2.0	<2.0
Isopropylbenzene	5	<2.0	<2.0	<2.0	<2.0	<2.0
n-propylbenzene	5	<2.0	<2.0	<2.0	<2.0	<2.0
1,3,5-Trimethylbenzene	5	<2.0	<2.0	<2.0	<2.0	<2.0
1,2,4-Trimethylbenzene	5	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,1-trichloroethane	5	<2.0	1.2J	<2.0	<2.0	<2.0
Naphthalene	10	<2.0	<2.0	<2.0	<2.0	<2.0
Methyl tertiary butyl ether (MTBE)	10	<2.0	<2.0	3.0	5.5	32.8
Total VOC Concentration	--	118.9	1,375.1	416.9	357.3	232.1

<sup>a</sup> Standard has not been established. Default value shown.

B = Compound also detected in blank sample.

D = Analytical value following dilution.

J = Estimated analytical value.

NA = Compound not analyzed for.

\*\* Primary breakdown products of carbon tetrachloride

Table 3. April 2002 VOC Analytical Results for Service Station Facility.

Compound	NYS AWQS (µg/L)	Well 085-235	Well 085-016)	Well 085-017	Well 085-236	Well 085-237
		----- (µg/L) -----				
Carbon tetrachloride	5	Well not sampled	1,750 D	526 D	445 D	265 D
Methylene chloride**	5		<0.5	<0.5	<0.5	<0.5
Chloroform**	7		36.2	35.3	28.7	17.2
Toluene	5		<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene (PCE)	5		5.2	14.4	4.4	2.3
Ethylbenzene	5		<0.5	<0.5	<0.5	<0.5
m,p-Xylenes	5		<0.5	<0.5	<0.5	<0.5
o-Xylene	5		<0.5	1.7J	<0.5	<0.5
Isopropylbenzene	5		<0.5	<0.5	<0.5	<0.5
n-propylbenzene	5		<0.5	<0.5	<0.5	<0.5
1,3,5-Trimethylbenzene	5		<0.5	<0.5	<0.5	<0.5
1,2,4-Trimethylbenzene	5		<0.5	<0.5	<0.5	<0.5
1,1,1-trichloroethane	5		0.6	0.5	<0.5	<0.5
Naphthalene	10		<0.5	<0.5	<0.5	<0.5
Methyl tertiary butyl ether (MTBE)	10		0.4J	3.8	NA	NA
Total VOC Concentration	--		1,792.4	581.7	478.1	284.5

<sup>a</sup> Standard not established – default value shown

B = Compound also detected in blank sample

J = Estimated analytical value

D = Analytical value following dilution

NA: Compound not analyzed for

\*\* Primary breakdown products of carbon tetrachloride.



Table 4. July 2002 VOC Analytical Results for Service Station Facility.

Compound	NYS AWQS (µg/L)	Well 085-235	Well 085-016)	Well 085-017	Well 085-236	Well 085-237
		----- (µg/L) -----				
Carbon tetrachloride	5	Well not sampled	344 D	334 D	343 D	183 D
Methylene chloride**	5		<2.5	<2.5	<2.5	<0.5
Chloroform**	7		34.0	39.8	32.2	16.4
Toluene	5		<2.5	<2.5	<0.5	<0.5
Tetrachloroethylene (PCE)	5		<2.5	16.2	7.4	2.9
Ethylbenzene	5		<2.5	<2.5	<0.5	<0.5
m,p-Xylenes	5		<2.5	<2.5	0.4J	<0.5
o-Xylene	5		<2.5	19.9	0.3J	<0.5
Isopropylbenzene	5		<2.5	<2.5	<0.5	<0.5
n-propylbenzene	5		<2.5	<2.5	<0.5	<0.5
1,3,5-Trimethylbenzene	5		<2.5	<2.5	<0.5	<0.5
1,2,4-Trimethylbenzene	5		<2.5	<2.5	<0.5	<0.5
1,1,1-trichloroethane	5		<2.5	<2.5	<0.5	<0.5
Naphthalene	10		<2.5	<2.5	<0.5	<0.5
Methyl tertiary butyl ether (MTBE)	10		<2.5	6.6	NA	NA
Total VOC Concentration	--		378	416.5	383.3	202.3

<sup>a</sup> Standard not established – default value shown

B = Compound also detected in blank sample

J = Estimated analytical value

D = Analytical value following dilution

NA: Compound not analyzed for

\*\* Primary breakdown products of carbon tetrachloride.

Table 5. September 2002 VOC Analytical Results for Service Station Facility.

Compound	NYS AWQS (µg/L)	Well 085-235	Well 085-016)	Well 085-017	Well 085-236	Well 085-237
		----- (µg/L) -----				
Carbon tetrachloride	5	115 D	93.5 D	339 D	404 D	214 D
Methylene chloride**	5	<2.0	<2.0	<2.0	<2.0	<2.0
Chloroform**	7	18.6	31.7	36.3	31.0	18.0
Toluene	5	<2.0	<2.0	<2.0	<2.0	<2.0
Tetrachloroethylene (PCE)	5	0.6J	<2.0	7.2	24.7	1.9J
Ethylbenzene	5	<2.0	<2.0	<2.0	<2.0	<2.0
m,p-Xylenes	5	<2.0	<2.0	<2.0	8.9	<2.0
o-Xylene	5	<2.0	<2.0	<2.0	10.2	<2.0
Isopropylbenzene	5	<2.0	<2.0	<2.0	<2.0	<2.0
n-propylbenzene	5	<2.0	<2.0	<2.0	4.9	<2.0
1,3,5-Trimethylbenzene	5	<2.0	<2.0	<2.0	5.3	<2.0
1,2,3-Trimethylbenzene	(a)	<2.0	<2.0	<2.0	12.7	<2.0
1,2,4-Trimethylbenzene	5	<2.0	<2.0	<2.0	18.2	<2.0
1-ethenyl-2-methylbenzene	(a)	<2.0	<2.0	<2.0	19.4	<2.0
1-ethyl-3-methylbenzene	(a)	<2.0	<2.0	<2.0	17.6	<2.0
1,1,1-trichloroethane	5	2.9	<2.0	<2.0	<2.0	<2.0
Naphthalene	10	<2.0	<2.0	<2.0	<2.0	<2.0
Methyl tertiary butyl ether (MTBE)	10	1.3J	<2.0	7.4	4.1	3.1
Total VOC Concentration	--	135.5	125.2	389.9	561.0	237.0

<sup>a</sup> Standard not established – default value shown

B = Compound also detected in blank sample

J = Estimated analytical value

D = Analytical value following dilution

NA: Compound not analyzed for

\*\* Primary breakdown products of carbon tetrachloride.

Table 6. December 2002 VOC Analytical Results for Service Station Facility.

Compound	NYS AWQS (µg/L)	Well 085-235	Well 085-016)	Well 085-017	Well 085-236	Well 085-237
		----- (µg/L) -----				
Carbon tetrachloride	5	Well not sampled	59.9 D	154 D	262 D	140 D
Methylene chloride**	5		<0.5	<0.5	<0.5	<0.5
Chloroform**	7		9.7	21.3	23.8	11.6
Toluene	5		<0.5	<0.5	0.3J	<0.5
Tetrachloroethylene (PCE)	5		0.5	10.5	14.0	1.7
Ethylbenzene	5		<0.5	<0.5	4.8	<0.5
m,p-Xylenes	5		<0.5	<0.5	31.9	<0.5
o-Xylene	5		<0.5	<0.5	14.2	<0.5
Isopropylbenzene	5		<0.5	<0.5	<0.5	<0.5
n-propylbenzene	5		<0.5	<0.5	7.2	<0.5
1,3,5-Trimethylbenzene	5		<0.5	<0.5	9.4	<0.5
1,2,4-Trimethylbenzene	5		<0.5	<0.5	26.4	<0.5
1,1,1-trichloroethane	5		<0.5	0.3J	<0.5	<0.5
1,1-Trichloroethane	5		<0.5	3.2	<0.5	<0.5
1,1-Trichloroethylene	5		<0.5	5.0	<0.5	<0.5
Naphthalene	10		<0.5	<0.5	<0.5	<0.5
Methyl tertiary butyl ether (MTBE)	10		<0.5	0.3J	NA	NA
Total VOC Concentration	--		70.1	194.6	394.0	153.3

<sup>a</sup> Standard not established – default value shown

B = Compound also detected in blank sample

J = Estimated analytical value

D = Analytical value following dilution

NA: Compound not analyzed for

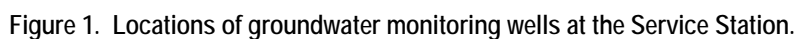
\*\* Primary breakdown products of carbon tetrachloride.

Table 7. March 2002 SVOC Results at the BNL Service Station.

Well	Sample Period	SVOC Results
085-16	March	ND
085-17	March	ND
085-235	March	ND
085-236	March	ND
085-237	March	ND
Typical MDL		10 ug/L

ND = Not detected

MDL = Minimum Detection Limit



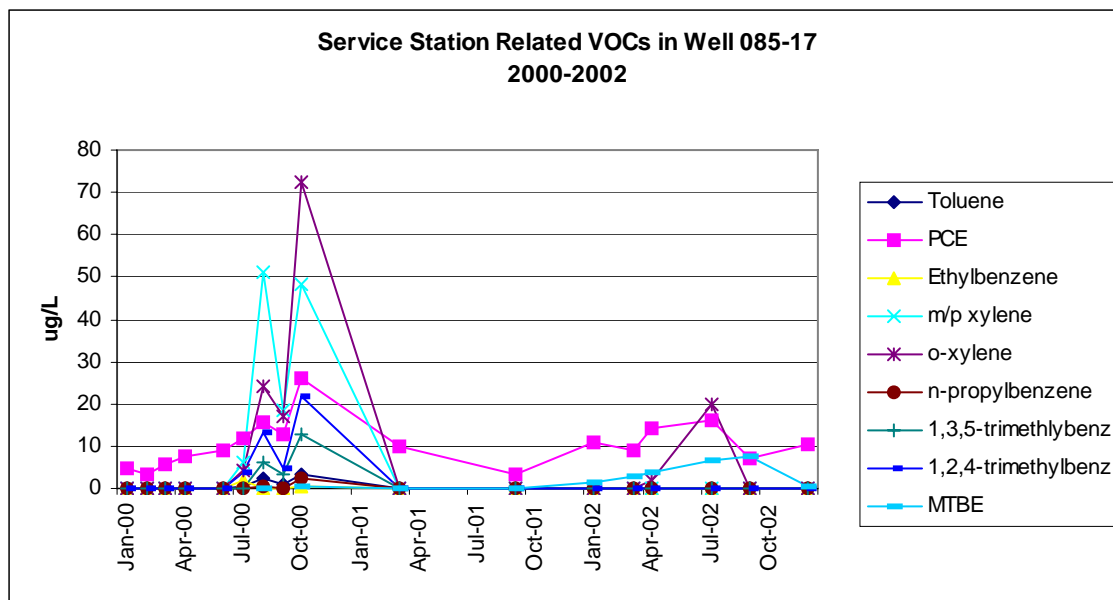


Figure 3. Trend of Service Station-Related VOCs in Downgradient Well 085-17. Note that carbon tetrachloride originating from the upgradient CCl<sub>4</sub> UST source area is not included.

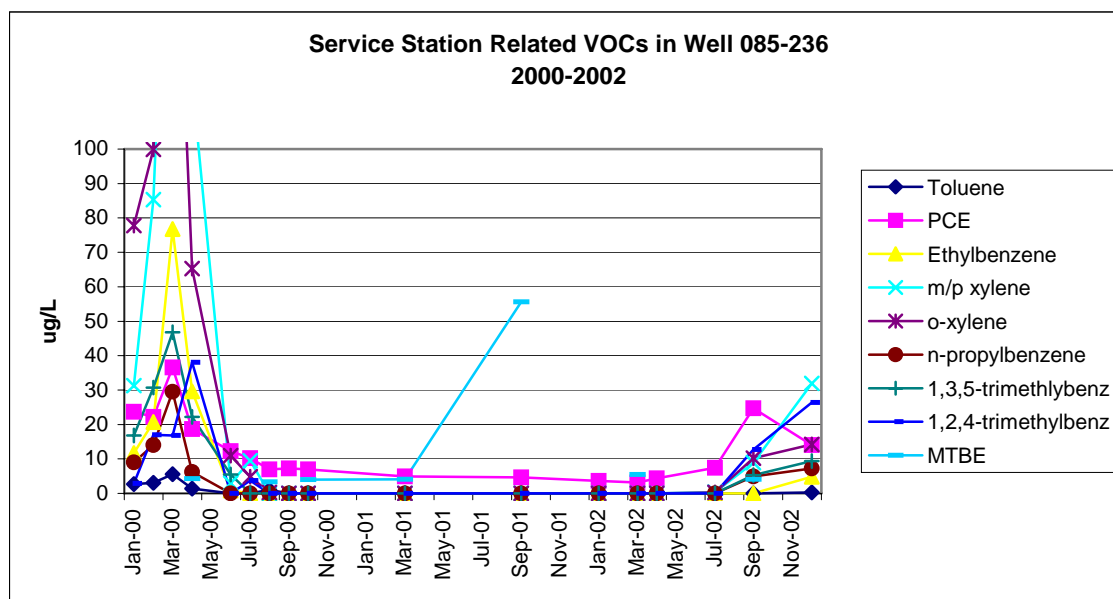


Figure 4. Trend of Service Station-Related VOCs in Downgradient Well 085-236. Note that carbon tetrachloride originating from the upgradient CCl<sub>4</sub> UST source area is not included.

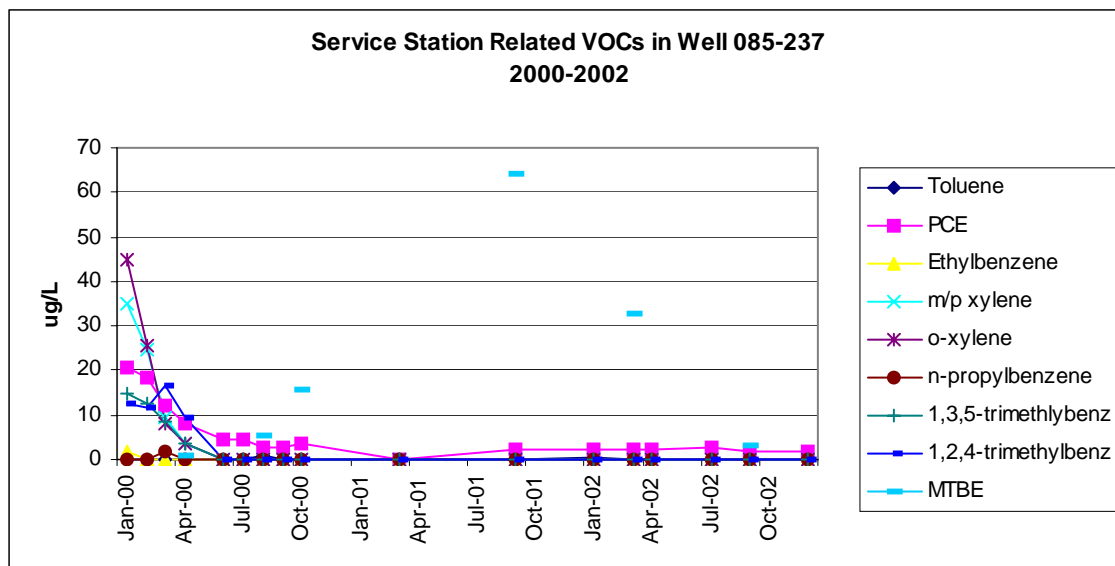


Figure 5. Trend of Service Station-Related VOCs in Downgradient Well 085-237. Note that carbon tetrachloride originating from the upgradient CCl<sub>4</sub> UST source area is not included.